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$$d^2 = \left(\frac{Ax}{a} - \frac{aX}{A}\right)^2 + \left(\frac{By}{b} - \frac{bY}{B}\right)^2 + \left(\frac{Cz}{c} - \frac{cZ}{C}\right)^2$$

$$= \frac{A^2x^2}{a^2} + \frac{B^2y^2}{b^2} + \frac{C^2z^2}{c^2} - 2(xX+yY+zZ) + \frac{a^2X^2}{A^2} + \frac{b^2Y^2}{B^2} + \frac{c^2Z^2}{C^2}. \quad (7)$$

From (1) and (2)

$$k^2\left(\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2}\right) - k^2\left(\frac{X^2}{A^2} + \frac{Y^2}{B^2} + \frac{Z^2}{C^2}\right) = 0. \quad (8)$$

Adding (7) and (8), regarding (3), (4) and (5),

$$d^2 = (x^2+y^2+z^2) - 2(xX+yY+zZ) + (X^2+Y^2+Z^2). \quad (9)$$

$$\therefore d = D.$$

PROBLEMS.

409. *By David Trowbridge, A. M., Waterburgh, N. Y.*—If in any triangle ABC, squares be described on the three sides, and the vertices of the squares be joined by the three straight lines a, b, c; show that

$$a^2 + b^2 + c^2 = 3(AB^2 + BC^2 + CA^2).$$

410. *By Prof. J. Scheffer.*—A cone with circular base is cut by a parabolic plane which passes through the centre of the base; to find the position of the centre of gravity of both portions of the cone.

411. *By Alex. S. Christie, U. S. Coast Survey.*—Sum the series

$$1 - \frac{n}{1}\,\frac{1}{3} + \frac{n(n-1)}{2!}\,\frac{1}{5} - \frac{n(n-1)(n-2)}{3!}\,\frac{1}{7} + \text{\&c.},$$

for positive values of n.

412. *By Prof. L. G. Barbour.*—Show that in any hexaedron bounded by quadrilaterals, the three lines respectively connecting the mean points of opposite (non-contiguous) faces, mutually bisect each other.

413. *By William Hoover, A. M.*—A rod rests with one extremity in a smooth plane and the other against a smooth vertical wall at an inclination a to the horizon. If it then slips down, show that it will leave the wall when its inclination is $\sin^{-1}(\frac{2}{3}\sin a)$.

414. Sum the series, $\sec\theta + \sec\frac{1}{2}\theta + \sec\frac{1}{4}\theta + \sec\frac{1}{8}\theta + \ldots + \sec\frac{1}{2_n}\theta$.

415. Evaluate $$\int\frac{dx}{x - dx}.$$

416. *By Prof. W. P. Casey.*—Given the base AB and the angle A of a triangle ABC; find the locus of the foot of the perpendicular CF drawn from C to the side of the inscribed square.

417. *By George Eastwood.*—Two boys, A and B, play a game at marbles. A deposits 50 white marbles in a bag; B deposits 50 yellow marb's of the same size and value as A's, in another bag, and the game is this:— The bags being placed in convenient positions, B, at a given signal, takes a marble out of A's bag and drops it into his own bag; then A takes a marble out of B's bag and drops it into his own bag. Next B takes another marble out of A's bag and transfers it to his own, and A then transf's one of B's marbles to his own bag, and so on. After 50 transfers from each bag to the other, in the above order, what is the probable number of white marbles found in B's bag, and how many transfers will B have to make to gain 25 of A's marbles?

PUBLICATIONS RECEIVED.

Linear Associative Algebra. By BENJAMIN PEIRCE, LL. D. New Edition with Addenda and Notes, by C. S. PEIRCE, Son of the Author. 133 pp., 4to. New York: D. Van Nostrand, Publisher. 1882.

Brief Description of the Algebra of Relatives. By C. S. PEIRCE. 4to. 1882.

The Reduction of Air-pressure to Sea-level at Elevated Stations West of the Mississippi River. By HENRY A. HAZEN, A. M. 4to. 42 pp., with 20 isobarometric maps. Washington: 1882.

Note on Hanson's General Formulae for Perturbation. By G. W. Hill. [Reprinted from the American Journal of Mathematics, Vol. IV, No. 3.]

Notes, Queries, and Answers. Vol. I. No. 1. July, 1882. 16 pp., 8vo. Monthly. S. C. & L. M. Gould, publishers, Manchester, N. H.

ERRATA.

On page 143, line 10, for value, read values.
" " " " 21, last word in line, for the, read these.
" " " " 7, from bottom, for "lemits", read limits.